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R. W. BELLOWS ET AL

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SEALING ARRANGEMENT

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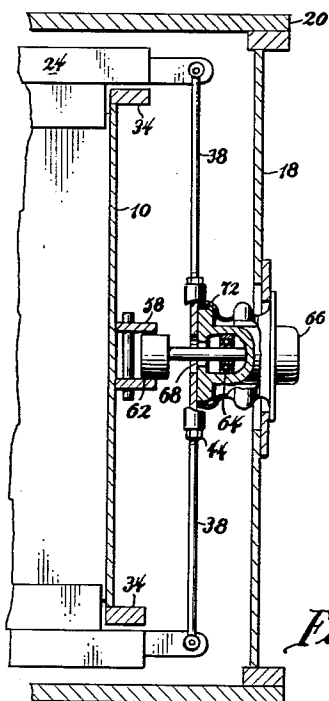


Fig. 1

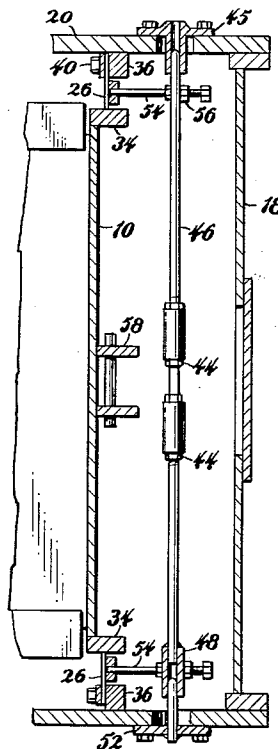


Fig. 2

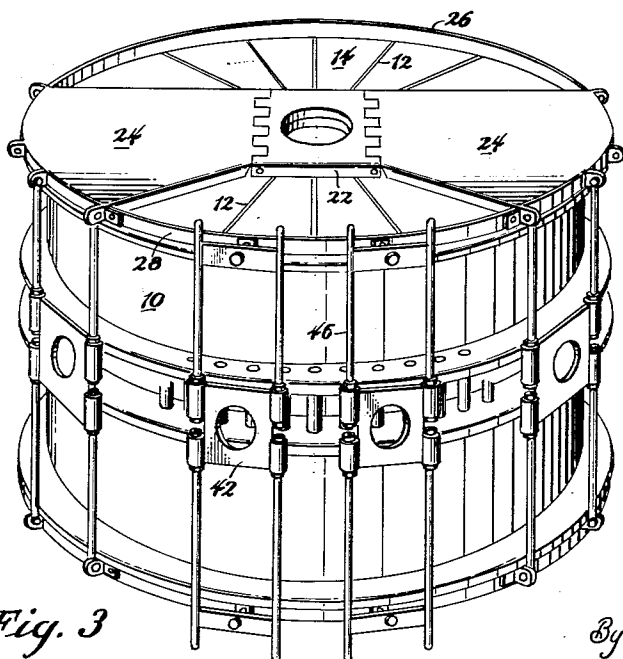


Fig. 3

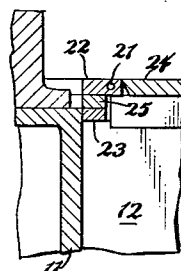


Fig. 4

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SEALING ARRANGEMENT

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3 Claims. (Cl. 257-269)

This invention relates to rotary regenerative air preheaters or the like, and especially to an improved sealing apparatus that precludes fluid flow between relatively movable surfaces thereof.

In rotary regenerative heat exchange apparatus a cylindrical rotor having compartments carrying heat absorbent material is mounted to rotate between spaced ducts through which flow a heating fluid and a fluid to be heated. The rotor is surrounded by a housing having end plates formed with openings that attach to the spaced ducts. In order to preclude the flow of heating fluid or the fluid to be heated through the clearance space between the rotor and the rotor housing without first passing over the heat absorbent material, it is customary to provide the rotor with circumferential and radial sealing means that wipe against the imperforate portions of the end plates.

Generally such heat exchangers are subjected to extreme structural and thermal stresses that cause the rotor and rotor housing to be distorted out of their original shape and vary the clearance space between rotor and rotor housing. Since the rotor is constantly rotating between the heating fluid and the fluid to be heated, the temperature of the rotor shell is never permitted to attain the extreme temperature of either of these fluids, and its distortion is therefore relatively slight. By contrast, certain portions of the rotor such as the end plates are constantly subjected to the flow of the heating fluid or the fluid to be heated whereby they attain and remain at the extreme temperature of these fluids and consequently become greatly distorted. It is to be seen therefore, that due to the greater temperature gradient across the end plates of the housing, the end plates are subjected to much greater distortion than is the rotor itself.

Since the sealing means are usually affixed to the rotor and adapted to wipe against the imperforate portions of the end plates, it is evident that the usual procedure is to seal against a surface that is subject to the greatest amount of thermal distortion.

This invention is therefore directed to a novel sealing arrangement that is carried by the end plates of the rotor and adapted to lie in sealing relationship with the end edges of the rotor or the surfaces that are subject to little thermal distortion.

The invention will be best understood upon consideration of the following detailed description of an illustrative embodiment thereof when read in conjunction with the following drawings in which:

FIGURE 1 is a fragmentary sectional elevation of a rotary regenerative heat exchanger that comprises my invention.

FIGURE 2 is a fragmentary sectional elevation of the rotary regenerative heat exchanger as seen from a different view.

FIGURE 3 is a perspective view of a rotor and combined sealing arrangement.

FIGURE 4 is a fragmentary view in section of the inboard support for the sealing means.

In the drawing a rotor having a cylindrical shell 10 is joined to a rotor post 11 by radial partitions 12 that form a series of sectorial compartments 14 adapted to carry a mass of heat absorbent material through which a heating fluid and a fluid to be heated are alternately

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directed. A housing 18 surrounds the rotor and is provided at opposite ends with end plates 20 having imperforate sections between spaced ports that are connected to inlet and outlet ducts for the heating fluid and the fluid to be heated.

The sealing means that precludes fluid flow between the relatively movable rotor and rotor housing at opposite ends of the rotor comprises:

A pair of sector plates 24 hinged at 21 to opposite sides of a ported center section 22. The center section 22 is supported on an annular sliding bearing 25 that is carried by flange 23 adjacent the ends of the rotor whereby the inboard end of each sector plate is permitted to rise or fall with the axial deformation of the rotor while the outboard end thereof may be moved axially with respect to the ends of the rotor.

A pair of arcuate sealing leaves 26-28 are fixed to the end edges of sectorial sections 24 to combine therewith and provide a circumferential sealing member, similar sealing members being provided at both ends of the rotor. An annular flange 34 extends radially outward from the end edges of the rotor shell to provide a broad sealing surface against which the end edges of sealing leaves 26-28 are adapted to lie in a sealing relationship. An annular connecting plate sealing member 36 having an inside diameter substantially the same as the outside diameter of circumferential sealing leaves 26-28 is welded or otherwise bonded to the inner surface of each end plate 20 to provide a fixed support for leaves 26-28. The member 36 extends axially to overlap sealing leaves 26-28 to thereby provide a lateral support for driving bolts 40 that extend through axial slots in members 26-28 to permit limited axial movement with respect to member 36.

In order that a predetermined spacing may be maintained between axially spaced sealing members, a series of axial connecting rods 38 are pivotally attached to the outboard ends of the sector plates. The rods extend axially to a ported roller mounting plate 42 where they are adjustably attached by means such as locknuts 44. A similar series of rods 46 outboard from sealing members 26-28 are adjustably connected to a roller mounting plate 42, then upper extremities being adapted to extend into sliding engagement with an opening in the upper connecting rod alignment bracket 45 while the lower ends of the rods are fitted with a sleeve 48 to provide a sliding fit for a protuberance extending upward from a lower connecting rod alignment bracket 52.

Each rod 46 is connected to the circumferential sealing member 26-28 by upper end lower guide pins 54, the guide pins being fixedly secured to the sealing members and adjustably secured to the rods 46 by a locking arrangement 56 that permits axial movement of the rods to vary the distance between axially opposite sealing members.

In arranging the assembly of actuating rods, the ported roller mounting plates 42 are adjusted to lie with the ports thereof in axial alignment with the annular pin rack and parallel guide rails 58 that extend around the rotor, the rails 58 thus being adapted to provide upper and lower guides for a roller or seal actuator 62 extending radially inward through the opening in each mounting plate 42. The roller 62 is supported for rotation by bearings 64 that are mounted in a housing 66 secured to the mounting plate 42. A packing gland 68 in the housing surrounding the roller precludes the flow of fluid past the roller, while a flexible housing 72 is positioned between the mounting plate 42 and an opening in the housing through which the bearing housing extends. Besides permitting relative movement between the mounting plate 42 and rotor housing 18, this arrangement permits the

bearings to be subjected to the relatively cool and clean atmosphere outside the housing.

When assembled with rollers 62 between guide rails 58, the adjusting nuts 44 are rotated to move rods 38 and 46, axially until the sealing leaves 26—28 are in sealing relationship with the plane end surface of radial flange 34, the preferred relationship being one where the sealing leaves lie just out of engagement with flange 34.

When in operation, any axial distortion of the rotor and its integral guide rails 58 will effect an axial movement of rollers 62 whereby rods 38 and 46 will be moved up or down in accordance with the distortion to maintain the prescribed sealing relationship between sealing assembly 24—26—28 and flanges 34. Furthermore, the radial width of flange 34 with respect to the width of sealing leaves 26—28 lying normal thereto assures a satisfactory sealing relationship throughout a wide range of relative radial expansion and contraction.

While this invention has been described with reference to the embodiment illustrated in the drawing, it is evident that numerous modifications could be made without departing from the spirit of the invention and it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What we claim is:

1. A regenerative air preheater or the like comprising a rotor having a cylindrical shell joined to a rotor post by radial partitions to provide sector shaped compartments that carry heat transfer material; a housing surrounding the rotor provided at opposite ends with end plates including inlet and outlet ducts for a heating fluid and a fluid to be heated; annular flange means around said rotor post adjacent ends of the diaphragms; a ported center section encircling said rotor post and slidably supported on said annular flange means; sector shaped sealing plates pivotally attached to opposite sides of said center section to permit axial movement thereof; circumferential sealing leaves extending arcuately from ends of the sector shaped sealing plates to form therewith an annular sealing member adapted to be moved axially toward and away from ends of the housing; and means

actuating said sealing plates into sealing relationship with the ends of the rotor to preclude leakage therebetween.

2. A regenerative air preheater or the like comprising a rotor having a cylindrical shell joined to a rotor post by radial partitions to provide sector shaped compartments that carry heat transfer material; a housing surrounding the rotor provided at opposite ends with end plates including inlet and outlet ducts for a heating fluid and a fluid to be heated; sector shaped sealing plates at opposite ends of the rotor pivotally mounted adjacent the rotor post to permit axial movement with respect to the ends of the rotor; circumferential sealing leaves extending arcuately from the ends of said sector shaped sealing plates to form therewith an annular sealing member having imperforate portions between spaced apertures; spaced connecting rods extending axially between sealing plates and sealing leaves at opposite ends of the rotor to provide a predetermined spacing therebetween; means carried by the housing adapted to limit the connecting rods to axial movement whereby the sealing leaves connected thereto are maintained in their predetermined arcuate relationship; and actuating means carried by said connecting rods operatively engaging said cylindrical shell and adapted to move the connecting rods axially in accordance with axial deformation of said rotor whereby the sealing leaves are continuously maintained in sealing relationship with the ends of the rotor.

3. A regenerative air preheater as defined in claim 2 wherein the rotor housing includes a series of openings formed radially outward from said actuating means, and a flexible housing surrounding each actuating means and secured at one end thereof to the periphery of said opening in the housing whereby the actuating means is subjected to ambient atmospheric conditions.

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